In the Drawings

Please replace current Figures 11 and 12 with corrected Figures 11 and 12 set forth in the replacement sheet attached hereto. Original Figures 11 and 12 incorrectly use the term "10^{10}" in connection with the plasma density values shown in the vertical axis. The correct term is --10^{11}--, which is used in corrected Figures 11 and 12.

Remarks

Claims 1-16 are pending herein. Claims 9-13 are withdrawn as being directed to a non-elected invention. By this Amendment, Figures 11 and 12 and claims 1 and 14 have been amended, and claims 15 and 16 have been added.

Figures 11 and 12 have been amended to change the term "10^{10}" in connection with the plasma density values to the term --10^{11}--.

Claims 1 and 14 have been amended to recite a flow-rate ratio of the ionization acceleration gas relative to the molecular gas in the process gas being 0.5 or above. Support for this recitation can be found in the specification at, e.g., page 15, lines 7-9.

New claim 15 depends upon claim 1 and recites that the process gas includes Ar, N_2, and H_2, and that a flow-rate ratio of Ar relative to N_2 and H_2 in the process gas is 5/9 or above. Support for claim 15 can be found in the specification at page 15, line 5 and in Figure 11. The flow-rate ratio of 5/9 or above recited in claim 15 can be read from Figure 11 as a flow-rate ratio [Ar/(N2 + H2)] = [200 ml/min/(180 + 180) ml/min] and [400 ml/min/(180 + 180) ml/min] = 200/360 and 400/360 = 5/9 and 10/9.

New claim 16 depends upon claim 1 and recites that the process gas includes Ar and NH_3 and that a flow-rate ratio of Ar relative to NH_3 in the process gas is 1.0/1.0 or above. Support for claim 16 can be found in the specification at page 15, line 5 and in Figure 12. The flow-rate ratio of 1.0/1.0 recited in claim 16 can be read from Figure 12 as a flow-rate ratio [Ar/(NH_3)] = [240 ml/min/240 ml/min] = 240/240 = 1.0/1.0.

In the Office Action, claims 1 and 2 are rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Application Publication No. 2003/0080091 to Nakaune ("Nakaune") in view of U.S. Patent No. 6,593,246 to Hasegawa ("Hasegawa") and Ono, Pure and Applied Chemistry, Vol. 66, No. 6 (1994) ("Ono"); and claims 3-8 are rejected under §103(a) as being unpatentable over Nakaune in view of Hasegawa and Ono as applied to claims 1 and 2, in further view of U.S. Patent No. 5,272,417 to Ohmi ("Ohmi"). Claim 14 is rejected under §103(a) as being unpatentable over Nakaune in view of U.S. Patent Application Publication No. 2004/0206725 to Fuse ("Fuse"), Hasegawa and Ono.

In view of the amendments and remarks herein, Applicants respectfully request reconsideration and withdrawal of the rejections set forth in the Office Action.

I. Rejection of Claims 1 and 2

Claims 1 and 2 are rejected under §103(a) as being unpatentable over Nakaune in view of Hasegawa and Ono.

Applicants respectfully submit that claims 1 and 2 would not have been obvious over Nakaune in view of Hasegawa and Ono.

In the method set forth in claims 1 and 2, the ionization accelerating gas not only has a maximum ionization cross-section of 2×10^{-16} cm^2 or above but also is ionized from a ground state or metastable state with an ionization energy of 10 eV or below. Because the ionization accelerating gas has both of these properties, the gas can improve significantly a plasma distribution without degrading plasma density (electron density).

For example, the property of the ionization accelerating gas being ionized from a ground state or metastable state with an ionization energy of 10 eV means that collision of particles having energy of at least 10 eV, such as free electrons, with atoms of the ionization accelerating gas, such as Ar atoms, cause the atoms to release electrons thereof to ionize.

On the other hand, Nakaune does not disclose such "ionization energy" but discloses "electron temperature" of 0.25 eV to 1 eV (see paragraph [0014]). In other words, Nakaune discloses kinetic energy of free electrons in heated plasma, i.e., not only already ionized/ dissociated but also a more activated/heated phase.

Furthermore, claim 2 recites that "a high-frequency power for generating the plasma is applied to the support electrode". Claim 2 also recites that the substrate is supported on the support electrode. On the other hand, in Nakaune, a microwave for generating the plasma is not applied to a wafer mounting electrode (11) but is radiated from an opposing antenna (6). A radio-frequency bias power is applied to the wafer mounting electrode in Nakaune (see paragraphs [0014], [0015] and [0020]. This feature is contrary to an object of Applicants' invention which is to etch an organic material film under a low self-bias voltage condition (see the instant specification at, e.g., page 3, lines 17-24).

In addition, claim 1 has been amended herein to recite a flow-rate ratio of the ionization acceleration gas relative to the molecular gas in the process gas being 0.5 or above. This feature makes it more certain that a plasma distribution can be significantly improved without degrading plasma density (electron density). Neither Nakaune nor the secondary references, i.e., Hasegawa and Ono, teach or suggest the flow-rate ratio recited in amended claim 1.

Thus, for at least the foregoing reasons, Applicants respectfully submit that claims 1 and 2 would not have been obvious over Nakaune in view of Hasegawa and Ono.

II. Rejection of Claims 3-8

Claims 3-8 are rejected under §103(a) as being unpatentable over Nakaune in view of Hasegawa and Ono as applied to claims 1 and 2, in further view of Ohmi.

Claims 3-8 depend directly or indirectly upon claim 1. As discussed above, Nakaune does not teach or suggest several features recited in claim 1. One of these features is the flow-rate ratio of the ionization acceleration gas relative to the molecular gas in the process gas being 0.5 or above. As noted above, Nakaune, Hasegawa and Ono do not teach or suggest this feature. Ohmi also does not teach or suggest this feature.

Therefore, for at least the foregoing reasons, Applicants respectfully submit that claims 3-8 would not have been obvious over Nakaune in view of Hasegawa and Ono and further in view of Ohmi.

III. Rejection of Claim 14

Claim 14 is rejected under §103(a) as being unpatentable over Nakaune in view of Fuse, Hasegawa and Ono.

Like the method recited in claim 1, the ionization accelerating gas used in the claim 14 method not only has a maximum ionization cross-section of 2×10^{-16} cm^2 or above but also is ionized from a ground state or metastable state with an ionization energy of 10 eV or below. As noted previously, Nakauno does not teach or suggest these features. In addition, like claim 1, claim 14 has been amended to recite a flow-rate ratio of the ionization acceleration gas relative to the molecular gas in the process gas being 0.5 or above. Nakauno also does not teach or suggest this feature. Fuse, Hasegawa and Ono also do not teach or suggest this feature.

Therefore, for at least the foregoing reasons, Applicants respectfully submit that claim 14 would not have been obvious over Nakaune in view of Fuse, Hasegawa and Ono.

IV. New Claims 15 and 16

Applicants respectfully submit that new claims 15 and 16 are patentable over the references cited in the Office Action. Both claims depend upon claim 1, and therefore include the features discussed above. As pointed out above, none of the references cited in the Office Action teaches or suggests the flow-rate ratio recited in claim 1. Therefore, for at least this reason, Applicants submit that claims 15 and 16 would not have been obvious over the references cited in the Office Action.

V. Conclusion

In view of the amendments and remarks herein, Applicants respectfully request that the rejections set forth in the Office Action be withdrawn and that claims 1-8 and 14-16 be allowed.

If any additional fees under 37 C. F. R. §§ 1.16 or 1.17 are due in connection with this filing, please charge the fees to Deposit Account No. 02-4300, Order No. 033082M257.

Respectfully submitted,
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Enclosures: (1) Request for Continued Examination
(2) Check for the Sum of $790
(3) Replacement Sheet for Figures 11 and 12

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